Introduction to Software Testing
Chapter 8.4
Logic Coverage for Specifications

Paul Ammann & Jeff Offutt

http://www.cs.gmu.edu/~offutt/softwaretest/

Specifications in Software

- Specifications can be formal or informal
  - Formal specs are usually expressed mathematically
  - Informal specs are usually expressed in *natural language*
- Lots of formal languages and informal styles are available
- Most specification languages include explicit logical expressions, so it is very easy to apply logic coverage criteria
- Implicit logical expressions in natural-language specifications should be re-written as explicit logical expressions as part of test design
  - You will often find mistakes
- One of the most common is preconditions …

Preconditions

- Programmers often include preconditions for their methods
- The preconditions are often expressed in comments in method headers
- Preconditions can be in javadoc, "requires", "pre", …

Example – Saving addresses

// name must not be empty
// state must be valid
// zip must be 5 numeric digits
// street must not be empty
// city must not be empty

Conjunctive Normal Form

Rewriting to logical expression

name != "" ∧ state in stateList ∧ zip >= 00000 ∧ zip <= 99999 ∧
street != "" ∧ city != ""

Shortcut for Predicates in Conjunctive Normal Form

- A predicate is in conjunctive normal form (CNF) if it consists of clauses or conjuncts connected by the and operator
  - A ∧ B ∧ C ∧ …
  - (A ∨ B) ∧ (C ∨ D)
- A major clause is made active by making all other clauses true
- ACC tests are "all true" and then a "diagonal" of false values:

	A	B	C	…
1	T	T	T	
2	F	T	T	…
3	T	F	T	
4	T	T	F	
		.		.
		.		.
		.		.

Shortcut for Predicates in Disjunctive Normal Form

- A predicate is in disjunctive normal form (DNF) if it consists of clauses or conjuncts connected by the or operator
  - $A \vee B \vee C \vee \ldots$
  - $(A \wedge B) \vee (C \wedge D)$
- A major clause is made active by making all other clauses false
- ACC tests are "all false" and then a "diagonal" of true values:

	A	B	C	...
1	F	F	F	
2	T	F	F	...
3	F	T	F	
4	F	F	T	
		.		.
		.		.
		.		.

Summary : Logic Coverage for Specs

- Logical specifications can come from lots of places :
  - Preconditions
  - Java asserts
  - Contracts (in design-by-contract development)
  - OCL conditions
  - Formal languages
- Logic specifications can describe behavior at many levels :
  - Methods and classes (unit and module testing)
  - Connections among classes and components
  - System-level behavior
- Many predicates in specifications are in disjunctive normal or conjunctive normal form—simplifying the computations